

Office Action Summary

Application No.

10/676,959

Applicant(s)

LU ET AL.

Examiner

Kevin P. Kerns

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 18 April 2007.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-10 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-10 is/are rejected.
- 7) ☒ Claim(s) 1 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 30 September 2003 and 25 January 2006 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Claim Objections

1. Claim 1 is objected to because of the following informalities: in the 7th line of the claim, delete “,” after “increasing region” for clarity. Appropriate correction is required.

Claim Rejections - 35 USC § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

3. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

4. Claims 1-10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Master et al. (US 5,988,485) in view of Parhar (US 6,752,309).

Master et al. disclose a method of assembling a substrate and a die in a flip chip configuration, in which the method includes the steps of applying a flux, including an organic flux solvent (e.g. alcohols) and a monomer to be polymerized (metal oxide-reducing activator that includes, for example, carboxylic acids that have a degree of water solubility depending on number of carbon groups), on a substrate having solder bumps (in which the solder bumps are selectively eutectic lead-based or lead-free with respective melting point values – column 2, lines 6-7; and column 3, lines 45-46), and placing a die on the substrate (see Figures 1 and 2); reflowing the die in a reflow device at a reflow temperature that is higher than the melting point of the flux solvent (to be vaporized during heating) and the monomer to be polymerized, with the reflowing temperature profile necessarily being a temperature/time profile that includes a heating (increasing) temperature that would rise to be higher than a melting point of a polymer and would result in a polymer liquid (and selected to match the respective melting points of eutectic lead-based or lead-free solder, as one of ordinary skill in the art would have recognized and optimized), a maintenance (nearly constant) temperature (at least for a brief period of time – e.g. milliseconds), and a cooling (decreasing) temperature, and forming solder joints from the melted solder bumps to be solidified (in addition to polymer liquid becoming solidified) in the transitional period between the maintenance (nearly constant) temperature and the decreasing temperature; removing the polymerized residue (from the completed monomer/polymer polymerizing process) in a cleaning (de-fluxing) process via an environmentally friendly water-soluble solvent heated to 70-90 degrees Celsius; and dispensing an underfill material in the gap

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between the die and the substrate (abstract; column 3, lines 33-67; column 4, lines 1-67; column 5, lines 1-4; and Figures 1 and 2). Master et al. do not specifically disclose that the flux monomer/polymer is (substantially or completely) water soluble, and thus lack the temperature profile with use of a substantially or completely water soluble flux.

However, Parhar discloses a method for using water soluble fluxes in either a monomer or polymer form for use with bonding with solder, in which the flux includes at least one wax carrier (column 1, line 45 through column 2, line 14), at least one surfactant (column 2, line 15 through column 4, line 5), and at least one activator (column 4, lines 6-58) and is configured to be heated to necessarily create a temperature/time profile of heating, nearly constant (at least for a brief period of time – e.g. milliseconds, at an “approximately constant region”), and cooling regions, such that the surfactant and activator components in the flux are substantially or completely water soluble, with the water soluble flux being advantageous for providing the ability to remove flux residue without exposure of people and the environment to harmful volatile organic chemicals (abstract; column 1, line 7 through column 5, line 9; and column 5 Table).

It would have been obvious to one of ordinary skill in the art at the time the applicants' invention was made to modify the method of assembling a substrate and a die in a flip chip configuration, as disclosed by Master et al., by using a flux that is (substantially or completely) water soluble with a defined temperature profile, as taught by Parhar, in order to provide the ability to remove flux residue without exposure of

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people and the environment to harmful volatile organic chemicals (Parhar; column 1, lines 13-23).

Response to Arguments

5. The examiner acknowledges the applicants' amendment received by the USPTO on April 18, 2007. The prior claim objection to claim 1 has been overcome by the applicants' amendment. However, a new claim objection to claim 1 has been raised in the amendment (see above section 1). Claims 1-10 remain under consideration in the application.

6. Applicants' arguments filed April 18, 2007 have been fully considered but they are not persuasive.

With regard to the applicants' remarks/arguments on pages 5-9 of the amendment, the applicants are referred to the newly underlined portions of the 35 USC 103(a) rejections of above section 4 (other portions of the rejections remaining unchanged). In the newly underlined portions (and with reference to the remarks/arguments on pages 5 and 6), it is noted that the primary reference (Master et al.) disclose the use of both eutectic lead-based and lead-free solder bumps, which have differing melting points and would require corresponding polymer melting points, as one of ordinary skill in the art would have recognized and optimized. In addition, the use of the term "if" (on two occasions) does not substantially limit the scope of amended independent claim 1, as polymer melting points of 183 degrees Celsius or below

encompass this limitation, and the wax carrier has a melting point from 55-150 degrees Celsius (also see 1st full paragraph on page 6 of remarks), which is well below 183 degrees Celsius. Regarding the applicants' arguments addressing the 35 USC 103(a) rejections, the examiner continues to respectfully disagree with the applicants' assertion that a *prima facie* case of obviousness has not been established for reasons set forth in section 4 and the reasons that follow (including those set forth in the final rejection of August 16, 2006 and Office Action of January 18, 2007). The applicants continue to provide arguments that generally attack the references individually, and clear motivation (in the absence of impermissible hindsight) in combining Master et al. and Parhar has been provided in the 35 USC 103(a) rejections of above section 4. In addition, the applicants continue to state (in the paragraph bridging pages 5 and 6) that "neither Master nor Parhar discloses or suggests a flux including at least a solvent and a water soluble monomer or water soluble polymer" (see the "applying" process step of claim 1). The examiner respectfully disagrees with this statement, as both Master and Parhar individually disclose a flux with these properties (see above section 4). Master et al. also disclose melting both the solder and the polymer (in which melting would occur for both materials in most solder reflowing processes, whether or not the polymer is water soluble or insoluble). Contrary to the applicants' remarks in the 2nd full paragraph on page 6 of the remarks, the temperature profile is necessarily (implicitly) present in the processes taught by both Master et al. and Parhar, and there continues to be no apparent reasons/evidence that support that the temperature profile of the applicants' process differs from the prior art. All reflowing processes necessarily have temperature

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profiles based on heating, maintaining, and cooling subprocesses. Contrary to the applicants' remarks in the last full paragraph of page 7, it is noted that Parhar does not teach away from the invention since column 1, lines 24-31 of Parhar addresses "background art" temperatures, not inventive temperatures of Parhar, which are set forth in column 1, lines 54-57 and column 4, lines 41-44. The examiner continues to respectfully suggest that the applicants file an amendment with an affidavit/declaration to support their (more specifically defined) temperature profile (as an improvement over the prior art). As mentioned above and in the prior Office Action, the applicants are generally attacking the references individually throughout the remarks section (despite evidence provided in the Master et al. reference, which discloses and/or suggests all features of claim 1 with the exception of that the flux monomer/polymer is (substantially or completely) water soluble, and thus lack the temperature profile with use of a substantially or completely water soluble flux), rather than considering the combined teachings of Master et al. and Parhar, and thus state that a *prima facie* case of obviousness has not been properly established.

In response to applicants' argument (on pages 8 and 9 of the remarks/arguments) that there is no suggestion to combine the references, the examiner recognizes that obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either in the references themselves or in the knowledge generally available to one of ordinary skill in the art. See *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988) and *In re Jones*, 958

F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992). In this case, Parhar is provided to remedy the deficiency (see the last sentence in the above paragraph) of Master et al. in order to provide the ability to remove flux residue without exposure of people and the environment to harmful volatile organic chemicals (Parhar; column 1, lines 13-23).

In response to applicants' arguments against the references individually, one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.*, 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986).

Conclusion

7. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

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8. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Dr. Kevin P. Kerns whose telephone number is (571) 272-1178. The examiner can normally be reached on Monday-Friday from 8:00am-5:00pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Patrick Ryan can be reached on (571) 272-1292. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Kevin P. Kerns *Kevin Kerns* 5/1/07
Primary Examiner
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May 1, 2007